

DOCKET NO: 231751US26YA

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

IN RE APPLICATION OF :
ERIC J STRANG : EXAMINER: SAXENA, AKASH
SERIAL NO: 10/673,507 :
FILED: SEPTEMBER 30, 2003 : GROUP ART UNIT: 2128
FOR: SYSTEM AND METHOD FOR :
USING FIRST-PRINCIPLES
SIMULATION TO CONTROL A
SEMICONDUCTOR MANUFACTURING
PROCESS

DECLARATION UNDER 37 C.F.R. 1.132

1. I, Dr. Andrej Mitrovic, am a named inventor on the related application 10/673,138.
2. Neither Sonderman et al nor Tan et al use a first principles simulation model. Rather, the models in these references are 1) simplified models based on former approximate solutions or 2) statistical or “learned” models tracking how the systems are expected to behave.
3. With the computing capability of Jain et al representing futuristic, unrealized capability, there is no reasonable expectation of success that computer-encoded differential equations of a first principles simulation model for a spatially resolved model of a semiconductor processing tool could have been solved in a time frame shorter in time than the actual process being performed in the semiconductor processing tool.

4. Prior to the filing of this application, a two-dimensional axisymmetric time-evolution temperature simulation of a chuck with a wafer, a plasma heat load, and a coolant heat removal was performed by myself. By setting initial and boundary conditions to values appropriate for the physical chuck setup, a time-evolving solution was obtained in less than 5 seconds, for a process of nominal duration of 60 seconds.

This simulation time gave a 12:1 factor time compression available for altering the controls to prevent running into "out-of-spec" process conditions, based on the prediction. This simulation result in less than 5 seconds occurred with all temperatures initialized to 0 deg C.

If an actual temperature at each time step from a previous wafer run had been used for initialization, the solver would not have had to make that many equilibrium iterations on each time step, even further shortening the time of solution.

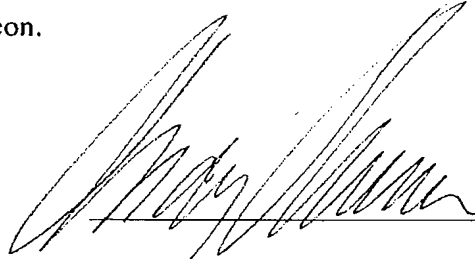
This result utilized a single core PC, with 1 GB of RAM (~2002), using ANSYS general-purpose simulation code, without any parallelization, and represented at the time an unexpected result.

5. Chen is a statistical simulator. At col. 5, line 38, to col. 6, line 25, Chen describes the use of a fitting function for fitting already simulated and measured data, not as a solution of a first principle simulation.

6. Chen is directed to the arithmetic manipulation of input data, and is not directed to any kind of solution, much less a "close-fitting solution," to a first principles simulation, as defined in Claims 23-26 and 60-63.

Application No. 10/673,507
Reply to the Board's Decision dated June 30, 2010

7. I declare that all statements herein are true or believed to be true, and further that these statements were made with the knowledge that willful statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of title 18 of the United States code and that such willful false statements may jeopardize the validity of the noted application or any patent issuing thereon.

 8-26-2010
Dr. Andrej Mitrovic Date